PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.

NOV 30 1926

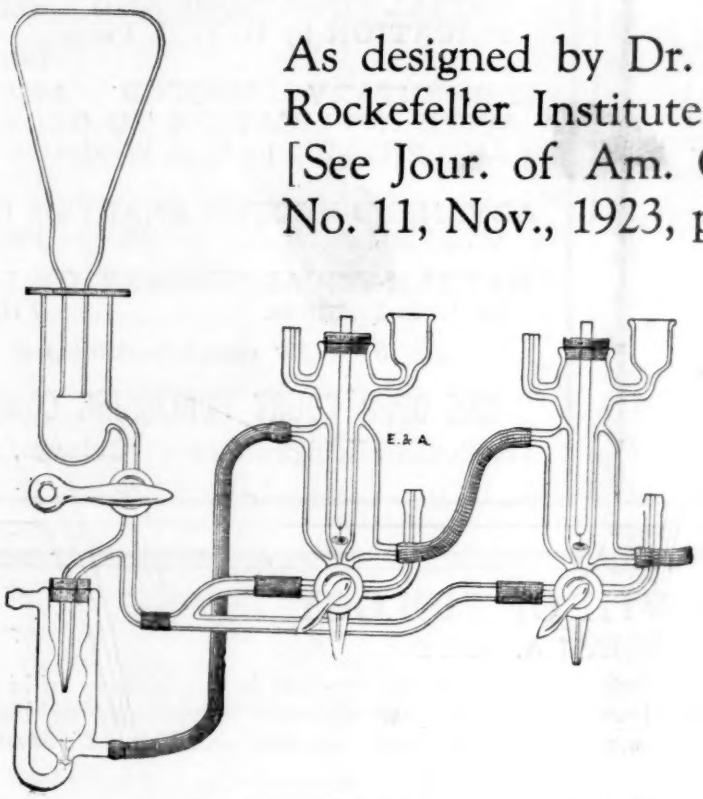
SCIENCE

NEW SERIES
VOL. LXIV, No. 1665

FRIDAY, NOVEMBER 26, 1926

ANNUAL SUBSCRIPTION, $6.00
SINGLE COPIES, 15 CTS.

Hydrogen Ion Outfit



As designed by Dr. Henry S. Simms, of the Rockefeller Institute for Medical Research. [See Jour. of Am. Chem. Soc., Vol. XLV, No. 11, Nov., 1923, page 2503.]

Gives accurate readings reproducible to 0.01 pH with 1 or 2 cc. of solution after three minute saturation with hydrogen, even with solutions of low conductivity, and offers greater convenience in manipulation when working with certain biological fluids than other types of cells.

Including two Water Jacketed Hydrogen Cells; Water Jacketed Calomel Cell; Special Salt Bridge and Reservoir, with soft rubber cover. $48.50.

We regularly stock L. & N. Conductivity and Hydrogen Ion Apparatus.

Our Glass Blowing Department makes a wide assortment of electrodes, cells and connecting vessels.

Write for further details, specifying your requirements.

EIMER & AMEND

Established 1851, Incorporated 1897

Headquarters for LABORATORY APPARATUS and CHEMICAL REAGENTS

NEW YORK, N. Y.
Third Ave., 18th to 19th St.

University of
CALIFORNIA PRESS

Plant Nutrition and Crop Production

By Sir E. J. Russell
Director of the Rothamsted Experimental Station

For the first time there is now presented, in vivid, accurate narrative, the complete story of the development of agricultural science, written by one of the foremost leaders in that field.

Every professor of agricultural science should have a copy of his own. It should be placed on the library shelves of every agricultural experiment station the world over.

115 pages, 58 illustrations. Cloth, postpaid, $2.75

University of California Press
Berkeley, California

We are the sole AMERICAN AGENTS for

BELL'S ADVANCED MATHEMATICAL SERIES

FIRST COURSE IN NOMOGRAPHY by S. Brodetsky. Price $3.00

PROJECTIVE VECTOR ALGEBRA by L. Silberstein. Price $1.75

FIRST COURSE IN STATISTICS by D. Caradog Jones. Price $3.75

ELEMENTARY TREATISE ON DIFFERENTIAL EQUATIONS AND THEIR APPLICATION by H. T. H. Piaggio. Price $3.50

ELEMENTARY VECTOR ANALYSIS WITH APPLICATION TO GEOMETRY AND PHYSICS by C. E. Weatherburn. Price $3.50

ADVANCED VECTOR ANALYSIS by C. E. Weatherburn. Price $3.50

MATHEMATICAL THEORY OF LIMITS by J. G. Leathem. Price $4.50

Send for complete catalog

THE OPEN COURT PUBLISHING COMPANY
122 South Michigan Ave. Chicago, Illinois.

THE GROWTH OF BIOLOGY
By WILLIAM A. LOCY

"This book is the culmination of the life work of our foremost student in the history of biology and it presents in a scholarly manner the development of our present knowledge of biology from the foundations so securely laid down by the classical Greeks."—*American Journal of Science.* $4.00

THE PEDIGREE OF THE HUMAN RACE
By H. H. WILDER, *Smith College*

"Professor Wilder has covered the field thoroughly from the viewpoint of a professional zoologist. He has written with immense erudition, frequent human touches, and yet didactically, but with not a little originality. . . . On the whole this appears to be Professor Wilder's best book."—Frank H. Hankins in *Social Forces.* $3.60

PRINCIPLES OF HUMAN GEOGRAPHY
By VIDAL DE LA BLACHE; translated by MILLICENT T. BINGHAM

Vidal de la Blache surveys the world, past and present, with a breadth of grasp which is unique. His sweep of thought bears the reader along on its world-wide quest. Geographers, geologists, and social scientists will find their thinking enlarged and illuminated by this point of view toward the interaction of man and his environment. $4.00

SEX HYGIENE
By DR. J. KINBERG-VON SNEIDERN and DR. A. SUNDQUIST

"I have read it over carefully and find it a real contribution on the subject. It is so clearly written and the language so simple and understandable, that I should think that it would have a wide circulation especially among college students really desiring information on this subject."—M. L. Ilsley, M.D., *Colgate University.* $1.75

HENRY HOLT AND COMPANY
One Park Avenue New York

SCIENCE

VOL. LXIV NOVEMBER 26, 1926 No. 1665

CONTENTS

The Medical Sciences: PROFESSOR FREDERICK P. GAY 511
The Virtue of Medicine as a Profession: PROFESSOR EDWARD L. KEYES 513
The American Association for the Advancement of Science:
Enrollment of the Association; Life Membership in the Association: DR. BURTON E. LIVINGSTON 517
Scientific Events:
New Methods in the Manufacture of Rubber; Plans for the Medical School at the University of Chicago; Smithsonian Radio Talks; Annual Meeting of the Geological Society of America 519
Scientific Notes and News 521
University and Educational Notes 524
Discussion and Correspondence:
Thallium as an Insecticide: C. H. POPENOE. *"Pink-Root" of Onions caused by Phoma Sp.:* H. N. HANSEN. *The Velocity of Gravitation:* PERCY M. ROOPE. *The Scientific Method and Authority:* PROFESSOR EDWIN LINTON 525
Scientific Books:
Kuster's Pathologische Pflanzenanatomie in ihren Grundzügen: DR. ERWIN F. SMITH. *Starks's Bones of the Ethmoid Region of the Fish Skull:* DR. DAVID STARR JORDAN 527
Scientific Apparatus and Laboratory Methods:
A Convenient Method for feeding Planarians: P. B. SIVICKIS 527
Special Articles:
Series Relations in the First Long Period: R. J. LANG. *Study on Sugar Cane Mosaic:* AUGUSTO BONAZZI. *Post-Larval Lobsters:* D. A. MACKAY 528
The National Academy of Sciences 530
Science News x

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.

New York City: Grand Central Terminal.

Annual Subscription, $6.00. Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 8, 1879.

THE MEDICAL SCIENCES[1]

YOU have probably been told that in this new field of endeavor on which you are entering you will learn at once a science and an art. An art is defined as "skill in applying knowledge or ability to the accomplishment of a concrete purpose." But the art of medicine includes a skill not required in the fine arts or in engineering; namely, the skill in human contact in its most intimate and revealing complexities. It is precisely this relationship with other human beings, and particularly in its helpful aspects, that has, I imagine, attracted most of you to the study of medicine.

But the successful practice of any profession depends on knowledge of the theoretical principles that underlie it. The earlier practitioners of the healing art were not long satisfied with mere empiricism, the simple method of trial and error; they began to theorize as to how the human body is constituted and how it functions. They speculated on the nature of disease processes and soon sought for causations in external agencies. They philosophized in an abstract fashion concerning the functional turmoil that leads to the subjective and objective symptoms of disease.

This form of explanation by pure reason soon showed the lack of sufficient information on which to base a logical hypothesis and led to the development of the more purely observational sciences of anatomy and pathology.

The understanding of normal and disorganized function, that is, of physiology under natural and abnormal conditions, required the additional aid of experimentation, and, with the firm adoption of this most revealing method of biology, the gateways were opened into the far-reaching and highly specialized fields of the sciences of medicine as we have them to-day.

The problems of medicine still arise at the bedside, but they are now answered in large part in the laboratory. Experimentation, and not merely increasing acuteness in observation, accounts for our progress to-day. The stored-up knowledge and the experimental skill necessary to forward any one of our present medical sciences is so great that it can be compassed only by a lifetime of endeavor. It is a rare practitioner, indeed, to-day, who can hope to heal the sick and at the same time contribute significantly

[1] The opening address before the entering class of the College of Physicians and Surgeons, September 22, 1926.

to the science that underlies his art. Hence has come increasing specialization, which is merely a reasonable division of labor.

We are still obliged from time to time to defend specialization, and, in regard to the practice of medicine at least, the wail has gone up that we are losing the general practitioner, the family physician. Goodness knows, in the usual complaints of life he is still more than friend. But both he and we, if we are wise, will wish to turn in difficult occasion to that particular specialist who has made a life study of our individual malady. But I am speaking here rather of the teacher and contributor to some branch of medicine which some of you, I hope, are ambitious to become. The days of the man who taught natural philosophy, of even of the man like the late Professor Chandler who taught chemistry in the university at large, in the school of mines and in the medical school, are gone. There were indeed giants in those days, but there are still; the division of labor lies not in the smaller intellectual stature of the professor but in the greater bulk of the science. All this is merely from the teaching angle. It is still less possible that a Leonardo da Vinci should leave his mark on several sciences to-day, as did the great Florentine in engineering, painting, sculpture, anatomy and mathematics. The fact is that the easy, though important, discoveries in these subjects have been made and those who come after must dig deep through facts that are known, to unearth gems that are new.

And among those whose endeavor lies in one of the medical sciences we find in increasing numbers not only those who have eschewed practice, but many who have even had no orthodox medical training. We have no more reason to demand that the present-day contributor and teacher of anatomy, biochemistry or physiology should have a medical degree than we should expect it in the physicist or chemist who is making even more fundamental contributions to medicine. These trends simply indicate that the medical sciences are coming of age and are taking their places among the more exact and more fully elaborated sciences.

Just where do these medical sciences of ours stand in the greater hierarchy? Most of us biologists have, I imagine, suffered acute attacks of the inferiority complex as we mingled with mathematicians, astronomers, physicists and chemists, feeling as we do that our methods, as compared with those of the older sciences, are still crude and our information decidedly sketchy. A refreshing breeze of self-esteem will come to many of us when we read the recent Silliman lectures delivered last year in Yale University by Gilbert N. Lewis, himself a distinguished contributor to three of these purer or more exact sciences. Lewis has the distinct impression that no science gains through mere aping of another science. Biology will become no more exact by attempting a purely mechanistic concept. He says: "In the snobbery of science each branch attempts to rise in the social scale by imitating the methods of the next higher (or more exact) science and by ignoring the sciences beneath." He feels no shame in exposing himself to the charge of vitalism when he gives the following illuminating conception of biological phenomena.

> Borel [he writes], in his "Elements of the Theories of Probability," makes the amusing supposition of a million monkeys allowed to play on the keys of a million typewriters. What is the chance that this wanton activity should reproduce exactly all of the volumes which are contained in the library of the British Museum? It certainly is not a large chance but it may be roughly calculated and proves in fact to be considerably larger than the chance that a mixture of oxygen and nitrogen will separate into its two pure constituents. But all such chances, small as they are, seem enormous compared with the chance that a living cell could result from the random arrangement and rearrangement of its atoms.
>
> Here we are beyond the help of mathematical calculations. But the observation of animate nature leads to the almost irresistible conviction that here emerges in our preception a new element, alien to the randomness that characterizes the physical sciences; indeed that living creatures are *cheats* in the game of physics and chemistry. It seems that animate creatures alone are striving for *distinction* in the midst of the almost overwhelming levelling forces in the great democracy of atoms.

Could any biologist justify his science and his present inadequacy in explanation more fully? Need you, embarking on the study of medicine, feel that you will step down intellectually in leaving your studies in chemistry and physics which are pursued by more accurate and well-aged methods? I hope you will conclude, as I do, that these new sciences with which you are to come in contact are less well formulated, not simply because they are younger, but because they are actually far more difficult.

If these remarks of Lewis and of mine have raised in your minds the fascinating but at present baffling complexity of the living cell or of those congeries of cells we call an organism—think further for a moment of the attempt to understand what happens when such a living organism is invaded by a wholly different and hostile foreign cell, as is the case in the infectious diseases.

I hope that some of these fascinating complexities will so appeal to a few of you that you will be glad

to devote your lives to their unraveling, but I realize that most of you are correctly destined to the more immediate task of protection and life-saving of the human individual or group. Your rewards in this case are more certain and immediate. I do not refer here to the financial rewards, which beyond a certain irreducible minimum are the least important elements of life, but to the rewards of grateful human response, of satisfaction from a life of unselfish and useful service.

In view of the manifest and worthy destiny of most of you there are many who in the next year and a half will question the wisdom of the course that is prepared for you. You will at times grow impatient at being held back from access to patients, which contact is certainly the lure that has brought you this far. You will wonder at the insistence on matters that, although in themselves of scientific interest to the specialist, have no obvious connection with the understanding and care of the sick human being. Why should you not immediately be ushered into the operating room and absorb gradually the modicum of science that is recognized as of purely practical value in your ultimate activity? You need have no hesitancy in asking yourselves or us this question, for it is one of the perennial ones in medical education and has recently been raised again with vehemence by certain clinical teachers. The answer, however, seems clear to most of us.

There are no doubts in the mind of any serious educator that, in preparation for the study of medicine, you should be required to know certain of the general principles of physics, chemistry and biology. You will recall that you learned chemistry, for example, as a self-sufficient science and not simply those parts of it that have to do with the compounding of drugs. In the same way the medical sciences should, and will be presented to you, as sciences complete and compelling enough so that those of us who present them to you are contented to devote ourselves wholeheartedly to their furtherance. There are none of us blind to the applicability of many of the phenomena which we demonstrate to you in the laboratory, in the elucidation, prevention and cure of disease, and we are proud so to designate them. But you will be struck to learn how many of these phenomena seemed at their discovery of purely theoretical interest. It is true that some of our most striking experimental results have so far remained merely curious scientific facts, but any one of you by examining one of these curious facts from a new angle of vision may turn it into a direct contribution to human welfare. In such a state of affairs who of us would venture to tell you what part of our science is purely useful and all that you need know to outfit you as useful practitioners of medicine?

Again it is not the facts and theories, with which you will be inundated from this day forth, that are primarily useful. The one thing we should like most to inculcate is a point of view: to teach the method of reasoning, first from cause to effect so that later, when you are called to deal with a sorry result, you can apply the reverse process and find and remove the cause.

We should like to teach you something of the processes of reasoning by which the great scientific discoveries have been made, to surround you with an atmosphere in which at least some, it may be faltering, progress of a similar sort is going on.

The word "research" is such an overworked one, used, as some one has recently expressed it, "by many professors for the purpose of reducing university authorities to submission," that one hesitates to use it. But research is simply experience, experiment and fact in the process of formulation. All that text-books hold and all that teachers talk about is somebody's researches in the past. But the research we shall talk to you about as you go on is the past experience lived over or amplified in work of the individual who brings it to you in a fresh and vital form. It is now an accepted truism that no one can teach inspiringly without himself having participated first hand in the evidence which he transmits. And I believe it is almost equally true that no one can investigate to the best advantage without reporting his results to others at intervals; in other words, without teaching.

We hope you will leave us with a better standard of measuring the value of the medical discoveries that are destined to come in your lifetime, with an understanding of how to apply them, and best of all with an ambition to have in some way your part in them.

FREDERICK P. GAY

COLLEGE OF PHYSICIANS
AND SURGEONS,
COLUMBIA UNIVERSITY

THE VIRTUE OF MEDICINE AS A PROFESSION[1]

IF I could have my wish, the welcome which I this day accord to you as you enter the study of your life work in medicine would remain in your memories as the morning star of your lives. I should fill your hearts with an enthusiasm that time itself could not efface, and to the end of your days you would remember with a thrill of delight the moment when you first fully realized the glory that awaits you, the joys that

[1] The opening address before the entering class of Cornell University Medical College, September, 1926.

should be yours in penetrating the mystery of health and disease, the glow of pride which will be honestly won by your service in behalf of suffering humanity. If my performance live not up to my aspiration, if my tongue fail to echo the thrill which I receive as I face your innocent pride of ambition, your young idealism to spend your lives as the "servants of the servants of God," grant me at least this, that I sense in you what is best in your human nature and that I foresee for you as the result of your choice of medicine as a career all that is most beautiful in human happiness. I can wish you no greater blessing than that which your profession will bestow upon you in the measure of your capacity, your industry and your ideals.

At this rosy moment of your professional dawn, relax and yawn cosily and wisely ere you face the work of the day. Breathe a prayer of praise and hope, those of you who are wise enough still to pray; the others gird up your loins for what will be a struggle to test your metal. For as you leave this hall you will plunge into a course of training such as not the sturdiest football hero among you has yet encountered. With small experience and few guides you will have to conquer in a few months the vocabulary, the methods and the facts of anatomy, and after that—but you do not need to be told the struggles through which you will have to win in order to merit the benediction I have wished upon you. No words can enforce that lesson. Rather I conceive it my duty to enlighten you upon what it is that Cornell University Medical College expects of you, her children, and what you may expect of her, your Alma Mater.

To-day opens your truly university career. As undergraduates you have hitherto been college and not university men. Although the college of to-day is liberal almost to excess in the choice of elective courses, liberal almost to laxity in its supervision of the morals and the manners of its students, liberal almost to delirium in the time and attention directed to extra-curricular activities, yet there remains as flavor of other days a theory of tutelage which you will not find here. Your college at least pretends to guide and assist you as much as possible in your pursuit of knowledge. Your university makes no such pretense. It accepts you as freemen, avidous for an education. It pampers you with no athletics. It concerns itself as little as possible with your personality. It demands of you a concentration and industry of which you have not hitherto dreamed and of which I fancy you would not hitherto have thought yourselves capable. If you are not prepared at once—to-day—to give yourselves unreservedly to your study of medicine, the university has no place for you and begs you to make way for some more deserving fellow. Farewell the bleachers! Farewell the twenty-five-hour week! Enter the midnight oil! Welcome the fifty-hour week!

Yet look over the curriculum and you will find a sufficient number of temptingly vacant half-days and scattered hours to encourage the hope that all is not so black as my blessing paints it. Be not deceived. These hours are given that in them you may digest your knowledge and by concentration upon the matter of your current study, by discussion, by reading, advance deeper—nay—advance the deepest you can in the knowledge of your science. Each one of you is regarded as an inspired seeker: act as such or depart!

A bit quixotic that sounds, does it not? It is worse than that. It means a complete conversion of ideal for many of you; a sloughing of the ideals of childhood in favor of those of maturity. Your major interests of the past I assume have been those of youth. Your dream has been a peaceful hour on the dreadful sea or the keen battle of some sport or a lyric to your lady's eyebrow. To such as these you have given your best endeavor, and during a certain time, at least, no toil has seemed too arduous, no abnegation too great a sacrifice to these, your gods. That now must change, though not in its essential character; only in its direction. Essentially you have felt in the vast of nature or in the lust of battle or in the spirit behind the eyebrow a something beyond your capture. Whether in love, in contest or even in vice, what you have pursued, perhaps quite unconsciously, is not a given beauty, a given victory, a given height, or even a given depth of degradation. Not at all! You have been all the while seeking the beauty of beauty itself, the glory of perfect victory, the height of heights, or the abyss of a truly bottomless pit.

This searching after the infinite it is, and this chivalresque tilting after the windmills of fancy, that you must concentrate upon the problems of medicine, if you wish to solve them. If this is too much to ask of you, go away. But if it is not, if perchance you feel in heart as well as in mind a faint stirring of nascent desire, a longing to lay hands on the mystery of life and death, a curiosity as to this queer rattling frame of ours, its defects and its disasters, then indeed welcome to you, ladies and gentlemen; push at the door of the temple, push hard and it will open to you its halls of curious delights. Through it you may press on a lifetime. You will not exhaust its treasures. Nay, in material things you will, most of you and the best of you as often as not, get little further than the grub-staked placer miner whose home is scarce a shelter, whose days are in the desert, whose fortune is at best a few nuggets. But each dawn shall find your eyes gazing at the distant mountains, your hearts filled with the faith that to-day is the day!

And what will Cornell figure in all this. After four years of study in her halls you will bear her imprint, be sure of that. What will that imprint be? Your minds will be filled with a new knowledge, a knowledge of the physics and chemistry of disease, a knowledge of its signs and symptoms, a knowledge of its prevention, its control, its treatment. But this you might expect to obtain at any medical college. Your curiosity will be whetted. What is now but a vague formless curiosity as to the workings of life in the human organism will have become a precise curiosity as to those portions of your studies that have taken strongest hold on your imagination. And one of the great glories of our science of medicine is that your curiosity will never be satisfied. However deeply you delve, however much you and your contemporaries invent, you need never fear that you will solve the ultimate mysteries. Your science will ever keep a long stride ahead of your capacity. Though what will be called modern medicine at the end of your lives will be a very different, a very inspiringly different thing from what we call modern medicine to-day, this in turn will pale before the medicine of the morrow which you shall not live to see.

But such beginnings any medical college might provide you. The imprint of Cornell will consist in the inspiration which you shall derive from the individual instructors under whom you will sit. Anatomy and physiology and pathology and the rest you will not get from your text-books, however furiously you grub in them. Your anatomy will be Stockard's anatomy, your physiology will be Lusk's, your chemistry Benedict's, your pathology Ewing's. I need not urge you to criticize your professors. Your native impudence will take care of that. But I beg you to strain a bit and admire your professors. You will find in them readily enough what you would not like to be. Search among them for what you would like to be, and above all have the good sense to hit upon the ones your several capacities may permit you to hope to initiate, for after some one or more of them your professional careers will inevitably be modelled.

I believe you have been justified in selecting Cornell for your medical education, and to prove me right you will have to illustrate in your own future careers some of the industry and enthusiasm you will find here illustrated. Such is the stamp we hope to impress upon you.

But I have ventured to entitle my remarks "The Virtue of Medicine as a Profession." To wish you a future merely as "rah-rah" Cornell boys is furthest from my intention. We, your professors, have to work with certain materials and these materials are two, *viz.*, your profession and yourselves. What, then, are the types of the medical profession. They are threefold, *viz.*, the science of medicine, the business of medicine and the art of healing.

The science of medicine I personally can but bow before. I have it not. I am nothing more than a clinician. A generation ago Johns Hopkins Medical School was founded and within its walls a serious concerted effort was for the first time in the United States made to establish the teaching of medicine upon a serious scientific foundation. I had no share of this. You will have much training in scientific method of which we had none. I never studied biology or embryology. I had but a bowing acquaintance with histology and pathology. I never did a blood count or an autopsy. I remember well the day when as an interne in the New York Hospital, I welcomed the return from Boston of my visiting surgeon, Dr. Stimson (Dr. Stimson, who a few years later with Dr. Polk was to found this medical college) with the news that he had met in that city a surgeon who pretended to analyze the suppuration in acute appendicitis by counting the white corpuscles of the patient's blood.

Biochemistry was not taught us and its children, endocrinology and scientific therapeutics and the rest, are younger in the domain of medicine than I, so that I am utterly unqualified to speak of the science of medicine and its method of thought. Yet I can not fail to observe and to admire wholeheartedly the rapid envelopment of the practice of medicine in the domain of science. This your profession now hands to you. It permits you, if you have the taste and the talent, the choice between a bewildering variety of sciences founded and sciences founding in the domain of medicine. It would be indeed an arid imagination that could not find a nest to its liking among them with the assurance that a lifetime could nowhere be more profitably and more excitingly spent than in this search for the elusive essentials of scientific truth that underlie the activities of life. What greater intellectual thrill can there be than that of the scientific pioneer? Medicine offers you that.

You who have concentrated with such ferocity at home upon the problems of the bridge table and in the field upon the technic of "following through," before you we propose to set, not merely a score of problems upon the solution of which rests the future history of mankind, rather a score of special sciences to that end—sciences in the making, physical sciences whose Newton is unborn, whose Einstein is undreamed of! If there is any love of truth, any human curiosity even, in you, search, search!—and realize that to-day you begin to learn the rules of the game!

And the business of medicine: that, too, is entirely new. When I was a medical student the health officer as we now know him was being born. Herman Biggs, its pioneer in this country, has but recently died.

Vital statistics were in that state which Grover Cleveland would have classed as "relatively derisory." Hygiene was a word for bathing your body and brushing your teeth rather than the name of a science. Health examinations were known, if anywhere, only in China, which was derided for paying its doctors only while the patient remained well. The life insurance companies had not thought how profitable it might be to keep their dividend payers alive. Hospitals were often only boarding houses for the sick, infant asylums the death warrant of infancy. I remember well the laugh that Dr. Lusk evoked with his plea for unified clinical hospital services with one responsible chief the year round. The clinician was too interested in his private patients to give up more than three months a year to the hospital. There was no "follow-up" of hospital cases. State medicine was not our fear, nor a Mayo clinic our ideal.

The business of medicine, alas, gets sadly on our nerves at times here in New York. Even education is tainted with business. The late and lamented President Eliot, in founding at Harvard the modern American university, gave us as president, not the scholar, but the business man. A pity I think this. Our practical genius as a nation could have profited by the continuation of the old style president, who like "*President de la Republique*" might have been included in Clemenceau's French summary of the most ornamental but useless things in the world—along with Italy and the prostate gland.

The daily needs of back and belly to-day press the purse as never before. To the trader's instinct that stamps the civilization of the United States and has kept our minds turned away from the exquisite delights of pure science so long, add the golden bait which the newly rich so casually dangle before the eye, and one may easily foresee that many of you weaker ones will despair of reaching the heights of truth and will desert the royal road of science for the shops that cluster along its way. Let it be a jest among you if you will that I have done as much, for in a sense you might class the clinician as business man, compared with the scientist. Yet I beg you to keep a distinction clear in mind. Ours is a profession, never a business. We live not primarily for the purpose of making money. Those of us who are the greatest successes and the happiest men make no more than a bare living. Our profit and loss is not measured in dividends. Our duty is to discover the truth and to present it to suffering humanity, from whom we may seek only that honorarium which we honor the public by permitting them to pay us according to their own honor (as Hamlet has it). We face life not as beggars, but proudly bearing gifts.

Fear not to give of time and enthusiasm and life itself to your profession and to your clients. Let truth and fidelity and gentleness be the coin of your realm, and the gates of state medicine shall not prevail against you.

You may think of the profession of medicine as a way to earn a living. It is not. With equal gifts and equal industry you might expect to gain a better living at many a trade than you will get from medicine. You can not hope to attain to success in medicine if you follow it for money. For no one is wealth less a measure of success than for us. We seem indeed more and more submerged in commercialism, ensnared in organization complexities born of the ambition to do better work, and ever burdened by the necessity to make that organization pay. But fear not! The great physician of every to-morrow, like the great physician of yesterday, will be he who spends himself in giving. Need I add that your giving will return to you a hundredfold in the affection, the adoration almost, of your fellowmen?

But, I hear the cry of youth. Applause you wish, the acclaim of your fellows—success, that is what you seek! Seek away, my lads! For, as Hans Breitman has it—

> **What is man's success,**
> **And what is several kinds of dings,**
> **And what is happiness?**
>
> **You finds a bank-note on de street,**
> **Next day de bank is break!**
> **You falls and knocks your outsides in**
> **When you a ten-strike make!**

You can not make yourselves successful; only the jade fortune can do that. Kissing still goes by favor in the merry old world, but I call your attention to the fact that kissing and laughter are among the few physiological phenomena that it has not seemed necessary to include in our curriculum. Such kissing as you encounter here will be quite unofficial. And such real success as you attain here will tinkle with laughter, I sincerely trust. But remember ever this, my friends: Though fortune makes success she never made a man. Him she can only mar. Alert, now! No more laughter! The bell is about to ring that will summon you to learn the things no item of which you may evermore forget. You can learn them only in digesting them and the evidence of such digestion you can only show by reproducing them—in writing now, in teaching them to others, we may hope, hereafter, thus passing on the torch. But remember this whimsical thought: when you have reached my age you will realize that you have learned in but two ways, *viz.*, by erring and by teaching—need I say more?

Go forth, therefore, and God speed you!

EDWARD L. KEYES
CORNELL UNIVERSITY MEDICAL COLLEGE

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

ENROLLMENT OF THE ASSOCIATION

THE permanent secretary's annual report on membership in the American Association, for the end of the fiscal year that closed September 30, shows that there were on that date 13,393 members in good standing, including 3 sustaining members, 418 life and emeritus members and 12,972 annual members whose dues had been paid for the year just ended. There were also on the rolls the names of 601 members in arrears for one year and 372 in arrears for two years, making a total enrollment of 14,366. Over ninety-three per cent. of the enrolled members were in good standing at the close of the year.

From September 30, 1925, to September 30, 1926, the gain in membership was 765 and the loss was 662. Of the latter number, 128 had died, 272 had resigned by letter and 262 had resigned automatically by allowing their names to be dropped from the rolls on account of more than two years of arrearage. The net gain in membership for the year was therefore only 103. The smallness of the net gain may well occasion serious thought, for the continued and rapid growth of the organization is of course highly desirable. That this gain was but 103 last year is specially remarkable in connection with the unusually large corresponding gains for the two previous years, which were 1,376 for 1924–25 and 1,183 for 1923–24, but the net gains for the next three still earlier years were very small—58 for 1922–23, 99 for 1921–22 and 105 for 1920–21. It is difficult to guess what may have been the influential conditions that determined such marked fluctuations in the annual increase in membership.

The following tabulation shows the general march of our enrollment since 1900, by five-year intervals and since 1920 by years.

Fiscal year (Oct. 1 to Sept. 30)	No. of members in good standing, end of year	Net gain during year	Total enrollment, end of year
1899–1900	.....	.....	1,921
1904–1905	.....	.....	4,041
1909–1910	.....	.....	7,950
1914–1915	.....	.....	8,325
1919–1920	10,002	.....	11,442
1920–1921	10,160	105	11,547
1921–1922	10,566	99	11,646
1922–1923	10,787	58	11,704
1923–1924	12,130	1,183	12,887
1924–1925	13,437	1,376	14,263
1925–1926	13,393	103	14,366

The mean rate of increase in the enrollment was nearly the same for the first, second, fourth and fifth five-year periods, but it was much lower for the third period (1909–10 to 1914–15). In the last six years the rate was low for the first three and for the last year, but remarkably high for the fourth and fifth years. The two years of great net gains were those of the third Cincinnati and the fifth Washington meetings.

Members of the association and all friends of science are asked to take every opportunity to increase our membership. There are surely many thousands of people who should take part in the work of the association but who are not yet members. The Washington office will furnish application cards, booklets of information concerning our organization and sample copies of the journal (SCIENCE or *The Scientific Monthly*) for use in securing new members, and it will aid whenever possible in any membership campaign that may be carried on locally. If each member might secure one new member the work of the association might be more than doubled. Any member of an officially affiliated organization, including the affiliated state academies, may now join the American Association without paying the regular entrance fee of five dollars. All members of affiliated organizations, as well as all other friends of science, should be members of the association, thus aiding in its work. From the standpoint of individual gain, the journal subscription alone is easily worth much more than the annual membership dues.

LIFE MEMBERSHIP IN THE ASSOCIATION

THIS is the season of the year when life members of the American Association for the Advancement of Science may gain a bit of real satisfaction by the contemplation of their peculiar state. On the first of October each year every member of the association receives a card from the permanent secretary's office in Washington. The cards sent to life members bear the pleasing and annually repeated remark that the office has not forgotten the life members and that their journal subscriptions (for SCIENCE or *The Scientific Monthly*) have been renewed for another year. These cards look much like those received by annual members in the same mails, but the former ask for no payment of dues, while the latter do ask for dues due October 1. A life member may complacently let the Washington office see to it that his name is kept on the association roll indefinitely and that his journal continues to be sent to him without interruption. He is glad that he once made the final decision to pay all his future dues in advance, at the same time

adding to the permanent endowment of the association. He congratulates himself that one small but otherwise inevitable responsibility and possible source of irritation has been forever banished from his year. His relation to the association is permanently established and he does not need to give any thought to the financial obligations of membership.

The annual summary of the status of membership, which is drawn up on September 30, shows the number of sustaining, life and annual members on the rolls at the end of the fiscal year. The last summary shows three living sustaining members, 418 living life members and 12,972 annual members in good standing, while 372 whose names are retained on the roll of annual members were in arrears for two years and 601 were in arrears for one year. The total number of members in good standing was 13,393 and the total enrollment was 14,366. There were nearly half as many living life members as there were annual members who were in arrears.

These statements should have interest for those who will become life members in the near future:—A life member now pays $100 at one time and is exempt from future payment of dues. With the adoption of the new constitution in December, 1919, the life-membership fee was increased from $50 to $100. These fees are added to the permanent funds of the association, only the income therefrom being available for expenditure. The treasurer's last annual report (September 30, 1926) shows $36,350 as the sum of all life-membership fees thus far received. Out of the income from the permanent endowment the treasurer pays annually for the journal subscription of each living life member. Of the names of deceased life members there were 166 and the fees of these deceased members are indefinitely continuing to aid the work of the association. An annual member who has previously paid the dues for the current year pays $95 on becoming a life member. If he is in arrears for one or two years he pays $100 and his arrearage is automatically cancelled, making his membership record continuous. Each new member of the association pays an entrance fee of $5, but this is now remitted if the new member belongs to one of the organizations that are officially affiliated with the association, including the affiliated state academies.

To become a life member is a definite and concrete way to contribute permanently to the advancement of American science. Actuarially considered, life membership is a good investment for the younger members. Life members are specially shown in the quadrennial directory of members of the association. A complete list of the names of all life members, living and deceased, was published in the last volume of the Summarized Proceedings.

In the case of life members it is sometimes difficult for the Washington office to keep the mail addresses correct. At the present time there are nine life members whose notification cards mailed last October 1 have been returned by the post office with the notation "Not found" or "Unclaimed." Information about these is greatly needed. These nine names in question are here published, with the address of each as it is shown in the Washington files. It is requested that information concerning present places of address or dates of death be sent to the permanent secretary.

Albert Herbert, 142 Edwin Place, Asheville, N. Car.
Jennie Herbert, 142 Edwin Place, Asheville, N. Car.
Mrs. R. Hoe, Jr., 180 West 59th St., New York, N. Y.
Friedrich Hoffmann, Charlottenburg, Kant Strasse 125, Berlin, Germany.
J. D. Marmor, 12 East 115th St., New York, N. Y.
Herschel C. Parker, 21 Fort Greene Place, Brooklyn, N. Y.
John Patten, 5 W. Franklin St., Baltimore, Md.
James H. Worthington, The Observatory, Four Marks, Alton, England.
Frederick W. Wunderlich, 184 Joralemon St., Brooklyn, N. Y.

Emeritus membership is a special form of life membership, by which the association honors annual members of the longest standing. This is made possible by the emeritus-membership endowment for this purpose, the greatly appreciated bequest of the late Jane M. Smith, of Pittsburgh, who joined the association in 1901 and died in 1911. The income from this endowment is used each year for the payment of life-membership fees for several new emeritus members, elected by the council. At the last annual meeting, at Kansas City, three emeritus members were elected, each of whom had been an annual member in good standing for more than fifty years. At the approaching Philadelphia meeting three additional emeritus members will probably be elected. The emeritus membership endowment should be increased by further gifts to the association. It is notable that the income, as it accrues, is added to the general endowment, like other life-membership fees, while, at the same time, it makes possible the conferring of a unique honor upon those who have continuously supported the association throughout the longest periods.

The names of all emeritus members are shown below, with the membership formulas. The number following the letter M shows the year of joining the association, that following the letter F shows the year of election to fellowship, that following the letter E shows the year of election to emeritus membership and that following the letter D (in the case of deceased members) shows the year of death. The name of each deceased member is preceded by a cross.

Arthur, J. C. M72, F83, E24.
†Beal, Wm. James. M68, F80, E17, D24.
Bethune, Rev. Charles J. S. M69, F75, E20.
Burgess, Thomas J. W. M89, F99, E18.
†Calkins, Marshall. M80, E18, D24.
Chamberlin, Thomas C. M72, F77, E23.
†Chandler, Charles F. M70, F75, E19, D25.
†Clark, John E. M68, F75, E21, D21.
Clarke, Frank W. M69, F74, E17.
Dall, William H. M69, F74, E17.
Dana, Edward Salisbury. M74, F75, E25.
Dimmock, George. M73, F74, E24.
Emerson, Benjamin K. M70, F77, E22.
†Fernald, Charles H. M06, F13, E18, D21.
Hervey, Alpheus B. M73, F79, E24.
†Hilgard, Eugene W. M57, F84, E16, D16.
Mees, Carl Leo. M75, F76, E26.
†Mendenhall, Thomas C. M71, F74, E15, D24.
†Morley, Edward Williams. M69, F76, E19, D23.
†Morse, Edward S. M69, F74, E15, D25.
†Paine, Cyrus Fay. M58, F74, E17, D21.
†Peck, Charles Horton. M02, F06, E15, D17.
Perkins, George Henry. M69, F82, E20.
Remsen, Ira. M73, F75, E25.
Rice, William North. M69, F74, E19.
Richards, Robert H. M73, F75, E18.
Smith, Eugene Allen. M71, F77, E22.
†Smock, John Conover. M74, F79, E26, D26.
†Stockwell, John N. M69, F75, E21, D20.
Tuttle, Albert Henry. M68, F74, E19.
†Wilbur, Albert B. M74, F74, E26, D26.
Wiley, Harvey W. M72, F74, E23.
Wurtele, Rev. Louis C. M57, F75, E16.
Yarrow, H. C. M74, F74, E25.

BURTON E. LIVINGSTON,
Permanent Secretary

SCIENTIFIC EVENTS

NEW METHODS IN THE MANUFACTURE OF RUBBER

THE *Journal of Industrial and Engineering Chemistry* reports the announcement from Akron, Ohio, that rubber experts predict revolutionary changes in the industry as a result of the development of a new process for the manufacture of rubber goods based on the electrodeposition of rubber.

Last year, Dr. S. E. Sheppard, of the Eastman laboratories, published the first announcement of his success in the electrodeposition of rubber. His was a painstaking piece of research undertaken primarily for the sake of establishing certain scientific facts. It is now stated that this work—as is so often the case—is about to yield very practical and profitable results. On October 28 there was formed at Akron the American Anode, Inc., by the B. F. Goodrich Co., the Eastman Kodak Co., and Anode Rubber Company, Ltd., of Great Britain, for the purpose of manufacturing rubber articles by a method different from any used by the industry heretofore.

The new organization backed by the large resources of the three parent companies has for its purpose the manufacture in America of rubber goods under processes patented by Dr. Paul Klein, of Budapest, and Dr. S. E. Sheppard and Dr. L. W. Eberlin, of the Eastman laboratories. The processes involve methods of compounding, milling and vulcanizing rubber.

"Under the new processes," one expert said, "the principle involved is the deposition of rubber on the anode of an electric circuit, the anode serving as a mold or form. Methods of suspending compounded ingredients in the latex electrolytic solution also have been perfected and patented as well as means for maintaining a constant concentration of the mixture."

It now is possible actually to rubber-plate molds of any shape with rubber of tissue paper thinness to several inches thick, Goodrich experts say. Arrangements already are being made with insulated wire makers to use the new process in insulating electric wires more speedily and with a far stronger coating.

Rubber bands no thicker than a thread have been manufactured here under the new process and have been found to be so much stronger than ordinary bands as to defy breaking by the bare hand. Other articles, such as silken thin tobacco pouches, bathing caps, gloves, and hot water bottles, similarly have been found to possess far greater strength and resiliency.

PLANS FOR THE MEDICAL SCHOOL AT THE UNIVERSITY OF CHICAGO

IN making the announcement of a gift of $3,385,000 from the General Education Board for the new medical school at the University of Chicago, already recorded in SCIENCE, President Max Mason called attention to the magnitude of the medical program which the university is about to inaugurate with the opening of its beautiful Gothic medical buildings covering two square blocks on the Midway. The new medical school, one of the most modern and complete in America, will provide hospital and clinic as well as facilities for medical study on a large scale in close proximity to the established scientific departments of the university.

The present gift, conditioned on the raising of $2,000,000 more for endowment, makes possible one of the most significant programs of medical education and research ever attempted in the United States. This program will be partially supported by assets brought up to $20,000,000 by the present gift.

President Mason said:

Perhaps the most striking feature of the whole program is the establishment on the campus of the university of clinical departments which are to function in the graduate school of science. This makes the medical sciences a definite and integral part of the university, tying them up in a very effective way with premedical sciences which have been highly developed in University of Chicago laboratories.

Buildings rapidly nearing completion will provide laboratories for physiology, physiological chemistry and pharmacology, medicine, surgery and pathology, the Albert Merritt Billings Hospital, and the Max Epstein clinic. These units, according to Dr. Franklin McLean, head of the department of medicine, will give the University of Chicago facilities for teaching and research in these subjects second to none in America.

As an integral part of the medical program will be conducted the work of the Douglas Smith Foundation for Medical Research, supported from the income of this $1,000,000 fund.

SMITHSONIAN RADIO TALKS

As a result of the taking over by the Radio Corporation of America during the summer of Station WEAF in New York and the discontinuance of Station WCAP in Washington, the radio situation in Washington became somewhat involved.

From Station WCAP Station WRC in Washington acquired the scientific talks of the National Research Council and of Science Service, as well as the interesting talks on natural history subjects arranged by Mr. Percival S. Ridsdale.

As WRC was already running the regular Smithsonian series of talks and the nature talks from the National Zoological Park some readjustment was necessary, as it was not practicable to give out so many more or less similar talks from a single station.

The situation was still further complicated by the fact that WRC had now become the Washington outlet for Station WEAF as well as for WJZ in New York.

The closest cooperation has from the first existed between the managers of all these series of scientific talks. Station WRC was having considerable difficulty in arranging its program, and especially in satisfying the demands for time from the two stations in New York.

The representatives of the Smithsonian Institution, the National Research Council and Science Service therefore asked the station to regard all the scientific talks collectively as a single unit and to allot to them such time as they wished, which allotment they would divide up among themselves.

Mr. Ridsdale's talks were of a somewhat different nature from the others, and could not well be combined with them. But in order to show the cooperation that existed between him and the managers of the other series, the director of the Smithsonian talks accompanied him to the station and introduced him to the staff on his first appearance over WRC.

The National Research Council decided to discontinue its series, and after a few talks Mr. Ridsdale also discontinued his. Science Service shortly after transferred its talks to Station WMAL, from which station they will be given beginning on Thursday, November 18, under the management of Dr. James Stokley.

This leaves the situation as it was heretofore, with the Smithsonian Institution the only organization giving scientific talks from WRC.

For the present the regular Smithsonian series and the nature talks from the National Zoological Park will be combined in a single weekly series which will be given on Wednesday evenings beginning on November 24.

AUSTIN H. CLARK

ANNUAL MEETING OF THE GEOLOGICAL SOCIETY OF AMERICA

THE thirty-ninth annual meeting of the Geological Society of America will be held Monday, Tuesday and Wednesday, December 27 to 29, 1926, at Madison, Wis., by invitation of the University of Wisconsin and the State Geological Survey.

The headquarters for registration and rooms will be in agricultural hall, University of Wisconsin. Members of the local reception committee will meet incoming trains and direct arriving fellows and visitors to their rooms and headquarters. The scientific sessions will be held in the auditorium of agricultural hall. Conversation, smoking and exhibition rooms will be provided.

The address of the retiring president, Andrew C. Lawson, will be delivered in agricultural hall, on Monday, December 27, at 8 p. m. A complimentary smoker will be held in the university refectory, on Monday, December 27, at 9 p. m. The regular annual dinner of the society will be held on Tuesday evening at 7 p. m., in the university refectory.

Accommodations for 250 or more guests will be provided in Tripp hall, one of the new dormitories for men. All rooms are single. Meals will be served for these guests at the university restaurant.

All sessions are open to the general public, but the council requests that the names and addresses of persons who are interested in geology and are de-

serving of recognition as visitors be sent to the secretary. The council will then invite them to attend the meeting.

The Paleontological Society will hold its eighteenth annual meeting at Madison, in room 305, agricultural hall, in conjunction with the Geological Society of America. The Mineralogical Society of America will hold its seventh annual meeting at Madison, in Room 206, agricultural hall, in conjunction with the Geological Society of America. Full information regarding this meeting may be obtained from the society's secretary, F. R. Van Horn, Case School of Applied Science, Cleveland, Ohio. The Society of Economic Geologists will hold a meeting for the presentation of technical papers in association with the Geological Society of America. The sessions will be held in Room 314, Agricultural Hall.

Further information may be obtained from the secretary, Professor Charles P. Berkey, Columbia University.

SCIENTIFIC NOTES AND NEWS

DR. JAMES FURMAN KEMP, professor of geology at Columbia University, died on November 17, aged sixty-seven years.

ON the occasion of the celebration of the fiftieth anniversary of its foundation, the Royal Geographical Society of Antwerp has conferred its gold medal on Sir Francis Younghusband. Sir Francis was present and spoke on "British Colonization in South Africa."

DR. KARL DIENER, professor of paleontology at the University of Vienna, has been elected a foreign member of the Geological Society of London and Dr. Otto Jaekel, professor of geology and paleontology at the University of Greifswald, has been elected a corresponding member.

DR. ARNOLD SOMMERFELD, professor of theoretical physics at the University of Munich, has been elected a foreign corresponding member of the Royal Society of London and an honorary member of the Manchester Literary and Philosophical Society.

THE Darmstädter prize of the Institute for Experimental Chemotherapy is to be awarded this year for the first time. The recipient is Professor R. Pfeiffer, of the University of Breslau, discoverer of bacteriolysins, of the influenza bacillus and of Pfeiffer's phenomenon.

DR. OTTO KNOPF, professor of astronomy at the University of Jena and director of the observatory, recently celebrated his seventieth birthday.

FORMER students of Dr. Edward Orton, pioneer in the field of ceramics and former dean of the college of engineering at the Ohio State University, have made an initial gift of $3,524 to establish a fellowship to be known as the "Edward Orton Fellowship in Ceramic Engineering." When through accrued interest and additional gifts the amount reaches $10,000 the income will be awarded annually to promising students in ceramics.

DR. GUIDO H. MARX, professor of machine design at Stanford University, has been chosen chairman of the Northern California Division of the American Civil Liberties Union.

HENRY H. HENLINE, associate professor of electrical engineering at Stanford University, has been appointed assistant national secretary of the American Institute of Electrical Engineers and will join the headquarters staff of the institute in New York City about January 1.

DR. F. C. FORSBECK, formerly of the Rockefeller Foundation, has been appointed to the position made vacant by the resignation of Dr. W. G. Weber as epidemiologist in the Massachusetts Department of Public Health.

DR. HENRY S. SIMMS has been transferred from the division of chemistry of the Rockefeller Institute for Medical Research in New York City to the department of animal pathology of the same institute, Princeton, N. J., where he has charge of the division of chemistry.

DR. C. JUDSON HERRICK, professor of neurology in the University of Chicago and managing editor of the *Journal of Comparative Neurology,* expects to spend the months of December, January and February in Europe. During his absence correspondence relating to the *Journal of Comparative Neurology* should be addressed to one of the other members of the editorial board of the journal or to the publication office. All proofs should be returned directly to the publication office at the Wistar Institute, Philadelphia.

DR. BAILEY WILLIS, professor of geology at Stanford University, is making a trip around the world.

DR. A. S. WILLARS, National Research fellow in photochemistry at Harvard University, has gone to Germany to spend a year working at the Institute of Physics at Göttingen under the direction of Professor J. Franck.

DR. ALICE HAMILTON, assistant professor of industrial medicine in the school of public health at Harvard University, will be on sabbatical leave for the academic year 1926–27. Her course in industrial toxicology is given by Professor Edgar L. Collis, from the University of Wales, Cardiff.

DR. EDWARD O. OTIS, honorary president of the Massachusetts Tuberculosis League and chairman of the educational committee of the Boston Tuberculosis Association, left on November 11 for a seven months' trip around the world. Dr. Otis's principal mission will be to secure a general idea of the tuberculosis conditions in the countries he will visit.

J. W. GREIG, of the Geophysical Laboratory of the Carnegie Institution of Washington, who has been on a year's leave of absence, part of which was spent at Harvard University and part with the Canadian Geological Survey, resumed his work at the laboratory in October.

DR. THEODOR VON KARMEN, professor of mechanics and aero-dynamics at the Institute of Technology at Aachen, Germany, at the invitation of the Guggenheim Foundation of Aeronautics is to give a series of lectures in various American universities.

PROFESSOR HERMANN WEYL, of Zurich, a delegate from Switzerland to the International Congress of Philosophy at Cambridge, Mass., recently visited several of the universities of the east and middle west. While at the University of Michigan he gave lectures on the "Rôle of Infinity" and "Modern Concepts of Gravitation."

DR. CHIYOMATSU ISHIKAWA, formerly professor of biology in the Imperial University at Tokyo, and Dr. Mikinosuki Kiyajima, one of the directors of the Kitasato Institute and professor in the Keio University, recently arrived in New York. They are visiting this country at the invitation of the Rockefeller Foundation to visit laboratories and discuss biological problems. Another biologist on the commission, who arrived here in October, is Dr. Naohide Yatsu, professor of biology in the Tokyo Imperial University.

J. DEWEY SOPER, a naturalist and explorer in the service of the Canadian government, has returned after three years spent on Baffinland, of which he has made a survey.

PROFESSOR K. F. MATHER, of the department of physiography at Harvard University, and Dr. J. R. Straton, pastor of the Calvary Baptist Church in New York City, debated in Boston, November 18, the question "Is the Theory of Evolution Incompatible with the Theory of Christian Religion?"

DR. MAURICE C. HALL, chief of the division of zoology in the U. S. Bureau of Animal Industry, gave a lecture on "Recent Developments in the Therapy of Helminthiasis," on November 19, in the series of public lectures at the Harvard Medical School, under the auspices of the School of Public Health.

DR. HUGH STOTT TAYLOR, professor of physical chemistry at Princeton University, will lecture before the Franklin Institute on December 2 on "Atomic Hydrogen and the Mechanism of Catalysis."

DR. E. P. WIGHTMAN, of the Research Laboratory of the Eastman Kodak Co., Rochester, N. Y., gave a lecture on "Some Mysteries of Photography," at the Brooklyn Institute of Arts and Sciences, on November 15. The lecture was illustrated with both lantern slides and motion pictures.

DR. FREDERICK S. HAMMETT, of the Wistar Institute of Anatomy and Biology, Philadelphia, delivered a lecture on "The Thyroid and Growth" before the Buffalo Academy of Medicine on November 10.

MISS CAROLINE A. LORD, of Cincinnati, has presented to Ohio State University an oil portrait of the late Professor H. C. Lord, professor of astronomy. The portrait will be hung in the classroom of the Emerson McMillin Observatory.

A TABLET is to be erected in the arch of the engineering building at the University of Michigan as a memorial to the late Professor J. B. Davis, who was professor of civil engineering in the university, by his former students.

DR. CHARLES E. WELLINGTON, formerly head of the department of chemistry at the Massachusetts Agricultural College, died on November 15 at the age of seventy-three years.

DR. DICK J. CROSBY, professor of extension work at the New York State College of Agriculture at Ithaca and nationally known for his work along agricultural extension lines, died on November 15, aged sixty years.

DR. E. S. BISHOP, formerly professor of clinical medicine in the Polyclinic Hospital and Medical School, New York City, died on November 15 in his fiftieth year.

PROFESSOR FRANZ EXNER, emeritus professor of physics at the University of Vienna, died on November 15 at the age of seventy-eight years.

THE United States Civil Service Commission announces competitive examinations for associate metallurgists and assistant metallurgists. Applications must be on file not later than December 7. The entrance salaries are $3,000 for associate metallurgists and $2,400 for assistant metallurgists, with the possibility of advancement to $3,600 and $3,000, respectively. Vacancies are to be filled in the Bureau of Mines and at Frankford Arsenal, Philadelphia, Pa.

THE third annual meeting of the Northwest Scientific Association will be held December 28 and 29 at

the Davenport Hotel, Spokane, Wash. There will be several general sessions and the meetings of the various sections. The address of the retiring president, Dr. M. A. Brannon, chancellor of the University of Montana, will be given at one of the general sessions. Applications for membership and titles of papers for the Spokane meeting may be sent to the secretary-treasurer, Dr. F. D. Heald, State College of Washington, Pullman.

THE New Mexico Association for Science held its eleventh annual meeting in Santa Fé, November 5 and 6, at which time a program of eleven papers was presented. The following officers were elected for the ensuing year: Kenneth M. Chapman, School of American Research, Santa Fé, *president;* F. M. Denton, New Mexico Normal University, East Las Vegas, *vice-president;* Paul P. Mozley, Albuquerque, *treasurer;* Edward Lighton, Albuquerque, *secretary.* The association decided by unanimous vote to affiliate with the Southwestern Division of the American Association for the Advancement of Science, which will hold its next annual meeting in Santa Fé.

A NEW scientific society was organized recently in Santiago, Chile, with the name The Chilean Society of Natural History (Sociedad chilena de Historia natural). The first officers are as follows: *President,* Professor Carlos E. Porter, zoologist, entomologist; *vice-president,* Professor Francisco Fuentes M., chief of National Herbarium; *secretary,* Mr. Gualterio Looser, honorary aid in anthropological section of National Museum; *assistant secretary,* Professor Gilberto Montero, professor of natural sciences; *directors,* Professor Marcial R. Espinosa, chief of cryptogamic botany, National Museum; Professor Miguel R. Machado, chief of geological and mineralogical section, National Museum; Fr. Flam. Ruiz P., professor of natural history, specialist in Apidae. The address of the society is Casilla 2974, Santiago, Chile.

TWENTY all Latin-American nations have been invited to participate in the 1927 Road Congress to be held in Chicago during good roads week from January 10 to 15. The meeting is to be the twenty-fourth annual convention and road show of the American Road Builders' Association. Invitations were extended presidents of all South American republics to appoint official delegates to the convention. According to H. G. Shirley, president of the association, the foreign delegates will be honored with a Pan-American day.

A SERIES of free public lectures to be held on Wednesday evenings at the Victoria Memorial Museum, Ottawa, has been arranged by a lecture committee consisting of Harlan I. Smith, M. E. Wilson and Clyde L. Patch. The program for November and December contains the following papers, each of which will be illustrated with motion pictures: November 17, "A Visit to the Stars," by R. M. Motherwell, of the Dominion Observatory; November 24, "Canada's Forest Wealth," by Roland D. Craig, of the Dominion Forest Service; December 1, "Iron in the Lake Superior Region," by T. L. Tanton, of the Geological Survey; December 8, "The Story of Our Migratory Birds," by Hoyes Lloyd, of the Canadian National Parks; December 15, "A Pinch of Salt," by L. H. Cole, of the Mines Branch; December 22, "Who Are the Indians?" by D. Jenness, of the Victoria Memorial Museum. The same series of lectures is being repeated on Saturday mornings for children.

PROFESSOR W. C. GRAUSTEIN has presented to the Société Mathématique de Belgique the amount of the prize that he received from the Royal Academy of Belgium for his memoir entitled "Methods invariantes dans le géométrie infinitesimale des surfaces" with the request that it be used to found a prize. This prize, which will be known as the Prix Graustein, will be awarded for an important contribution to infinitesimal geometry; competition will be restricted to the United States and Belgium.

THE department of tropical medicine of Harvard University announces a gift from Mr. Herman A. Metz, of New York City, for the purpose of furthering the work of the department in its study of spirochaetal diseases. Through the generosity of Mr. Metz, an additional member has been nominated to the staff of the department for the investigation of the biological characteristics of some of the less common pathogenic spirochaetes.

THE *London Times* states that by the generosity of Sir Otto Beit, who has promised to place at the disposal of the trustees of the Beit fellowships for scientific research a further sum of £15,000, the trustees announce that they are now in a position to award all the fellowships within their gift for the definite period of two years instead of for one year as hitherto. The fellowships now current were given for two years, and it is anticipated that future awards will be made on that basis. The extension of tenure will greatly enhance the value and confirm the prestige of these fellowships throughout the scientific world. Since 1913 eighteen Beit fellows in all have pursued their scientific research in the laboratories of the Imperial College at South Kensington.

A DONATION of £10,000 has been made to the British Association for the Advancement of Science by Sir Alfred Yarrow, following a donation of the same amount made by Sir Charles Parsons some years ago. Sir Alfred Yarrow, feeling that the present

urgent needs of the association, in its work for science, should receive precedence over provision for the distant future, has made it a condition that his gift should be expended, as to both capital and interest, within a period of twenty years. Sir Charles Parsons has expressed himself similarly with regard to his gift.

THE REV. FRANCIS DAVID MORICE, fellow of Queen's College, Oxford, and for twenty years an assistant master at Rugby School, who died on September 21, left his collections of insects, cabinets and store boxes, microscopic slides, microscopic and photographic apparatus, books and manuscripts and photographs of entomological objects to the University of Oxford for the Hope department of the University Museum. He also left £500 to Queen's College, Oxford, and £200 to the Entomological Society.

THE Zentralanstalt for meteorology and geodynamics at Vienna, which was founded in 1851 at the instance of the Vienna Academy of Sciences, has reached its seventy-fifth anniversary. At the suggestion of the director, Dr. F. M. Exner, the academy has celebrated the event by issuing a *Festschrift* dedicated to the institute. The volume, of about 200 pages, contains thirteen papers by Austrian and German geophysicists.

THE Harvard College Observatory has received a cablegram from the Central Bureau of Astronomical Telegrams in Copenhagen announcing the discovery of two comets. Neither body is visible without the use of telescopes. A new comet of the twelfth magnitude was discovered on November 5 by Professor J. Comas-Sola, of Barcelona, Spain. It is in the Mira Ceti, and the detailed observation is right ascension, 2 hours, 56 minutes, 36 seconds, declination north six degrees, 31 minutes. The other comet was discovered on November 5 by Professor G. Neujmin, of Simeis, Russia, of his own comet, originally discovered some years ago. It is of the fourteenth magnitude and in the constellation of Leo, not far from Regulus in the Sickle.

UNIVERSITY AND EDUCATIONAL NOTES

THE late Mrs. Elizabeth Clark Rogers, of Brookline, Mass., has bequeathed $75,000 to Harvard University and the residue of her estate, estimated at approximately $300,000, to the medical school of the university.

HARVARD UNIVERSITY has authorized plans for two new chemistry buildings, to include complete laboratories and research divisions, estimated to cost in excess of $1,250,000. It is expected to ask bids on general contract early in November.

WITH the purpose of endowing a chair of operative dentistry, the Philadelphia alumni of the University of Pennsylvania's school of dentistry have begun a campaign for $200,000. The chair will bear the name of Edward Tyler Darby, emeritus professor of operative dentistry in the university.

DR. E. A. BOYDEN, assistant professor of comparative anatomy in the Harvard Medical School, has been appointed associate professor of anatomy in charge of the department of anatomy of the University of Illinois. Dr. Boyden's place is to be filled temporarily by Dr. Torr W. Harmer, assistant in anatomy and in surgery.

THE Mount Sinai Hospital announces the following appointments: Dr. Louis Gross, formerly of McGill University, as acting director of laboratories; Dr. Gregory Shwartzman, formerly of the New York Homeopathic Medical School, bacteriologist; Dr. Michael Heidelberger, formerly of the Rockefeller Institute, chemist; Dr. Paul Klemperer, formerly of the Post-Graduate Medical School and Hospital, pathologist. Extensive alterations are being made in the laboratories to accommodate a complete full-time staff.

APPOINTMENTS for the year 1926–1927 in the anthropological division of the Institute of Psychology, Yale University, New Haven, have been announced as follows: Fellowships, Dr. Paul Radin, research fellow; Dr. Beatrice Blackwood, international fellow from England; H. D. Skinner, Rockefeller Foundation fellow from New Zealand; research assistants, Dr. Sophie de Aberle, Emily Marion Pilpel, Helen Heffron Roberts.

THE department of soils and crops in the experiment station and the department of agronomy in the school of agriculture at Purdue University have been consolidated into a department of agronomy, headed by A. T. Wiancko. G. H. Cutler, formerly head of the department of agronomy of the University of Alberta, has been appointed professor of agronomy and assistant chief of the department.

DR. CHARLES R. BRANCH has been appointed assistant professor of pathology at the Boston University School of Medicine.

ERNEST CLARE BOWER, associate astronomer at the United States Naval Observatory, has been appointed assistant professor of astronomy and mathematics in Ohio Wesleyan University.

DR. WALTER DIX, professor of plant anatomy at the University of Kiel, has received a call to the University of Giessen.

DISCUSSION AND CORRESPONDENCE

THALLIUM AS AN INSECTICIDE

THE remarkable properties of the metal thallium and its salts have recently been the subject of considerable research among biochemical workers, and thallium sulphate has attained some commercial use as a poison for rodents, both in this country and Europe. W. J. Dilling (Ann. Appl. Biol., XIII, 165–167, 1926) found that thallium ion was potent in checking both growth and germination in the seeds of cress, and that tadpoles were killed on emergence from the egg by N/500,000 solutions of thallium nitrate. Small doses of thallium acetate caused rats to lose all their hair except the tactile hairs (Buschke and Peiser, Klinische Wochenschrift, V. 977, 1926).

The writer knows of no experiments toward determination of the toxicity of thallium to insects. Its present price appears to make improbable its application to large scale economic entomological operations. Nevertheless, experiments undertaken in a small way during the past spring and summer indicate that thallium sulphate has a limited field in the control of house ants. The small red ant (*Monomorium pharaonis* L.), a species which arsenic sirups fail to control, has been exterminated in a number of houses and apartments within periods of three weeks to a month by the application of a sirup prepared by the writer and consisting of 1 pint water, 1 pound sugar, 27 grains thallium sulphate and 3 ounces honey, the whole being brought to a boil and thoroughly stirred. The ants continue to consume this sirup until the entire colony is destroyed, the thallium appearing to act as a slow cumulative poison, the effects of which are apparent in observable colonies by the considerable numbers of dead queens, larvae and workers discarded daily. The pavement ant (*Tetramorium cespitum* L.) is even more readily controlled, while several other species have shown themselves susceptible. The value of this poison on other insects is being tested.

C. H. POPENOE

U. S. DEPT. OF AGRICULTURE,
BUREAU OF ENTOMOLOGY

"PINK-ROOT" OF ONIONS CAUSED BY PHOMA SP.

WITH the rapid development of the onion industry in the west and southwest there has been a corresponding increase in loss from the "pink-root" disease. For this reason considerable time and effort have been devoted, at this laboratory and elsewhere, to studies of the various phases of this disease. Taubenhaus[1] presented evidence that, in Texas, the causal organism is a species of *Fusarium*, which he named *Fusarium malli* Taub. Later, in California, Sideris[2] isolated and named four new species and two new varieties of *Fusarium* which he had found associated with the disease.

The writer of this note, also working in California, has observed that the extent and diversity of the cryptogamic flora obtained when diseased onion roots are cultured depend largely on the condition and treatment of the material used. If the roots cultured are partly decayed and shrivelled they yield a large number of *Fusaria* and several other members of the soil flora; if, on the other hand, roots are cultured that, though distinctly pink, are still turgid and firm, the number of fungi obtained is greatly reduced, and if roots in the same condition are immersed in mercuric chloride 1:500 for three minutes and then cultured only one fungus is obtained which, according to the following description, belongs in the genus *Phoma:* Pycnidia subglobose, gregarious, dark-brown to black, 170–250 μ, conidia oblong, hyaline, one-celled 3–3.5 x 1.2–1.5 μ escaping as a gelatinous cirrus.

Typical "pink-root" symptoms, a diffuse pink color, followed by shrivelling of invaded parts, were readily produced in roots of onion seedlings grown in sterilized soil inoculated with *Phoma sp.* The organism was reisolated in pure culture from affected parts.

H. N. HANSEN

LABORATORY OF PLANT PATHOLOGY,
UNIVERSITY OF CALIFORNIA

THE VELOCITY OF GRAVITATION

FOR many years the velocity of gravitation or more properly the velocity of propagation of gravitational potential has been the subject of much theoretical discussion. The magnitude of this velocity according to proposed theories varies from the velocity of light to infinity. According to the theory of relativity the velocity of gravitation should be equal to that of light and the success which the experimental tests of the theory have met justify this assumption. No previous work has been done, however, which would form the basis of a direct measurement. During the past year certain experiments relating to the velocity of gravitation have been devised and partially tested but since no immediate results may be expected it seems best to make note of the method employed.

The attractive force of the sun on a mass situated on the surface of the earth varies by small amounts

[1] Texas Agr. Expt. Sta. Bull. 273: 1–43. 1921.
[2] *Phytopathology,* 14: 211–216. 1924.

with the position of the sun. The time curve of the force in the direction of the vertical contains two maximum and two minimum points daily. If gravitation travels with the same velocity as light one of these points should occur at exactly noon local apparent time. If gravity has an infinite velocity the minimum point should occur about 8.3 minutes before noon since light requires that interval of time to pass from the sun to the earth. In other words, the velocity of gravitation is to be compared with the velocity of light, or

$$v = \frac{t}{t + t'} c$$

where v is the velocity of gravitation, t the time for light to travel from the sun to the earth, t′ the time displacement between the observed minimum and noon, and c the velocity of light.

The final form of apparatus used consisted of a mass attached to the end of a flat steel spring which was bent almost to its elastic limit and adjusted so that the mass could move in a vertical direction. For recording the position of the mass a modification of the ultramicrometer circuit was employed in connection with galvanometer, rotating drum with photographic film, and timing apparatus.

The problem is not as simple as stated above, since both the sun and the moon exert tidal forces, but these effects may be separated mathematically from the displacement curves.

These experiments were carried out in the Physics Laboratory at Clark University but no results were obtained because the effect sought was masked by earth tremors of local and possibly distant origin. Because of the importance to theoretical physics of the quantity in question it is hoped that the work may be continued with more refined apparatus and in a suitable location.

The writer wishes to express his thanks to Dr. R. H. Goddard for his interest in the work and his many valuable suggestions.

PERCY M. ROOPE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
OCT. 14, 1926

NOTE ON THE SCIENTIFIC METHOD AND AUTHORITY

YESTERDAY I received a marked copy of the August-September (1926) issue of *The Bible Champion*, Reading, Pa., which had been forwarded to me from Augusta, Georgia. The sender had marked with blue pencil an editorial, pp. 406–407, entitled: "The Scientific Method and Authority," signed L. S. K., which initials indicate that the editorial had been written by an associate editor, Leander S. Keyser, D.D.

Dr. Keyser says that an obliging friend had sent him copies of SCIENCE containing a long article by me which he finds to be "out and out for evolution" and with which he finds serious fault. Thus: "But in this whole amplified article not an established fact is cited to prove evolution. Not a word occurs to prove spontaneous generation, or transformism, or man's animal pedigree."

Dr. Keyser also finds fault with my treatment of Price's "The New Geology." "He tries to find in it," he says, "a technical error, and in that way thinks he has discounted the whole work. Whether there is such an error or not we do not know, but are very much inclined to doubt it."

Of course I would not ask SCIENCE to give space for a discussion of Dr. Keyser's criticism. But since some publicity has already been given to the matter I should like to be permitted to call the attention of Dr. Keyser and those who think as he does to the fact that the article which he finds to be so objectionable was a vice-presidential address made before Section F, zoology, at the Kansas City meeting of the American Association for the Advancement of Science. With such an audience, and with the topic which I was trying to discuss, which, by the way, was not specifically evolution, it would have been quite inappropriate to have presented arguments for any phase of the evolution problem. For such an audience as that which listened to the paper the term evolution is a convenient name for the processes of nature which we see going on about us, and of which we are a part, of which also a partial record is preserved in the earth's crust, and elsewhere in the visible universe. It is only when an attempt is made to explain how any particular thing comes to be as it is that any theory of evolution is introduced.

As to my treatment of "The New Geology" it may also help to a better understanding of the address when it is remembered that the audience, although mainly zoologists, could be presumed to be well enough acquainted with the science of geology, and especially of paleontology, to make it unnecessary to have it pointed out to them the transcendent absurdity of the position taken by the author of "The New Geology" on such subjects as catastrophism and the contemporaneity of fossils.

Since, in a letter which I have received from another reverend theological unbeliever in the divine testimony of the rocks, I have been called to account for my lack of appreciation of Price as a geologist, it may be worth while to make a brief comment.

Following the quotation which I made from "The New Geology" to illustrate the author's view of the contemporaneous existence of living forms, whose

fossils have been referred by geologists to such severally remote times as the Ordovician and Tertiary, for example, it would have been appropriate to add that such a view of fossil records would be paralleled, and not in the least exaggerated, by the thesis that George Washington, Queen Elizabeth of England, Charlemagne, Cleopatra and the Pharaoh Tut-Ankh-Amen were contemporaries in the sense in which that word is used in human affairs.

Perhaps I may be permitted space to comment on Dr. Keyser's strictures on the scientific method as opposed to authority by asking, in all seriousness, how we are to arrive at a satisfactory conclusion as to the claims for credibility of different systems of religion except by the employment of the scientific method.

EDWIN LINTON

ZOOLOGICAL LABORATORY,
UNIVERSITY OF PENNSYLVANIA

SCIENTIFIC BOOKS

Pathologische Pflanzenanatomie in ihren Grundzügen, Dargestellt von DR. ERNST KUSTER, Professor der Botanik an der Universität Giessen. Dritte, neu bearbeitete Auflage. Mit 285 Abbildungen im Text, darunter 2 farbigen. Verlag von Gustav Fisher in Jena, 1925. Pages, XII, 558. Price: paper cover, 24 gold marks; bound, 26 marks.

PUBLISHER and author have both done their best to make the third edition of Dr. Küster's "Pathological Plant Anatomy" an attractive and useful book. It is one that should be in the hands of every professional plant pathologist and of every student who can read German. In 570 well-illustrated compact pages the author deals with all the more important phases of the morbid anatomy of plants, summarizing what is best known. The book is divided into two parts of about equal size. The special part deals with: (1) Panaschierung; (2) etiolation; (3) hyperhydric tissue, and under this, with overgrowth of lenticels and bark, and with intumescences; (4) wound tissue and regeneration, callus, thyloses, wound wood, wound bark, wound cork, gum and resin formation and regeneration; (5) galls. The second general part deals with: (1) Histogenesis of pathological tissues with eleven subdivisions; (2) developmental mechanics of pathological tissue with five subdivisions; (3) ecology of pathological tissue. The book also has a brief supplement and a good index. It is the best book there is on this subject and is likely to remain so for a considerable time. Most of the references are to German literature. Judging by the number of original figures (82 out of 175) the subjects most familiar to Dr. Küster are variegation, wound reactions and the anatomy of insect galls. Most of the illustrations in the other chapters (91 out of 109) are borrowed. There is a commendable abundance of literature references and the figures are good.

ERWIN F. SMITH

Bones of the Ethmoid Region of the Fish Skull. By EDWIN CHAPIN STARKS, (Stanford University, California, Biological Sciences, Vol. IV, No. 1).

THE osteology of the bony fishes, an immense and highly varied group of animals, has been relatively neglected of late years. For while these creatures date back to the separation of the land-breathing animals from primitive fishes, they are out of the line of descent which leads towards mammals and men. This memoir of Professor Starks's comprises a very thorough study of the bones of the roof of the mouth in fishes, and their evolution from the one end of the long series to the other. No study of vertebrate morphology can safely lose sight of the osteology of fishes, to which the present paper is one of the most notable contributions. An earlier paper by the same author (Vol. III, No. 3) deals with the Osteology and Relationships of the Uranoscopoid Fishes (Star-gazers), a large group in which the systematic position of many of the families is still in doubt. The true place in Taxonomy and in Evolution (which should be the same thing) can rarely be determined until the bony structure, which underlies superficial traits, is well understood.

DAVID STARR JORDAN

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A CONVENIENT METHOD FOR FEEDING PLANARIANS

THERE are many biological problems for which planarians and rhabdocoeles may serve as very suitable material and in many laboratories these animals are kept for some length of time for this purpose. With a proper care as in Professor Child's laboratory, University of Chicago, they live well on beef liver. In Manila we found that beef liver can not be used to our entire satisfaction. On account of a warm climate the liver soon putrefies and after a few hours the water becomes very polluted and injurious to the animals. Besides this, the fresh beef liver is not always obtainable when it is needed. This led me to search for other food materials which could be used in place of beef liver.

After some investigation, it was found out that the yolk of egg is a very convenient food material. The duck's egg on account of its denser yolk is better than the hen's egg, but the latter is quite satisfactory. The method of feeding which I adopted is very simple. A wide-mouthed pipette (with 3 to 4 mm opening) is inserted in a freshly opened egg so as to get directly

into the yolk without taking in any albumen. If some albumen gets into the pipette it does not do much harm except that it increases the bulk of material which is apparently not eaten and later has to be removed. The pipetteful of yolk is taken and then by a pressure it is placed at the bottom of a dish where the planarians are kept. The yolk usually gets out from a pipette in the form of a ribbon which pressed out sinks down to the bottom or may be attached to the sides of the dish if desired. Planarians if hungry respond to the food at once. They gather from all directions, eagerly eat the yolk, and in fifteen or twenty minutes most of them become yellow on account of the ingested food. If just a sufficient amount of yolk is given, practically all of it is eaten up and there are no remains left after the feeding. If more than necessary has been placed in the dish, the excess should be removed before any putrefaction sets in. It may remain for a day or so without any harm, but this depends upon the sensitivity of the animals toward the decaying food materials. With the Philippine planarians the yolk may be kept for a couple of days without any bad effect.

Using this method of feeding and changing water once a week (or even once in two weeks in more neglected cultures) I kept my stock of planarians for over a year in a very good condition. In these cultures, especially in the ones which had a few stones at the bottom of a dish, the animals not only lived well but some of them became sexually mature and even laid the eggs.

Entomostracans, such as Ostrocoda, Annelids, especially Aeolosoma, and rhabdocoeles also thrive well when fed on egg yolk.

The yolk is not only good as a regular food, but it is also very suitable for feeding these animals for use in the study of problems of digestion. The yolk can be easily beaten with non-irritant coloring matter such as carmine and then fed to the animals. With carmine beaten with the yolk I was able to obtain preparations of planarians showing the digestive system well.

In the sea water the yolk can not be used for this purpose. Here it goes in solution, and it soon makes the water foul without doing any good to the animals.

P. B. SIVICKIS

DEPARTMENT OF ZOOLOGY,
UNIVERSITY OF THE PHILIPPINES

SPECIAL ARTICLES

SERIES RELATIONS IN THE FIRST LONG PERIOD

IN *Nature*, July 24, 1926, I reported the discovery that certain pairs of lines appearing in the high-potential spark spectra of these elements seem to be the first P doublets. These are shown in Table I, which is quoted here for reference.

Further series relations for these elements are now given in Tables II and III. The wavelengths of already known lines are quoted from Fowler's Report, with the exception of the single line of Sc II, Table II, which is taken from Ireton's paper[1] and the Ca sextet, which comes from Russell and Saunders' paper.[2]

TABLE I

FIRST P DOUBLETS

Element	Wave length I. A. vac	I	Wave number	Separation
K I	7664.94	10 R	13042.82	57.71
	7699.01	10 R	12985.11	
Ca II	3933.66	10 R	25414.41	222.85
	3968.47	10 R	25191.56	
Sc III	2699.9	10	37038.4	474
	2734.9	9	36564.4	
Ti IV	2067.6	9	48363	821
	2103.4	8	47542	
V V	1680.4	5	59510	1462
	1722.7	3	58048	
Cr VI	1446.7	4	69123	2367
	1498.0	2	66756	

It will be noted that the intensity of the pairs of doublets decreases continually with increase in atomic number and that the shorter member of each pair has the greater intensity. Of course the intensity given for the first two pairs is quoted from the report and no direct comparison is intended between this and the intensity of the following pairs. It was found, however, that the Ca lines were very much more intense than those of Sc on the same plate.

The existence of these doublets from Sc onward, if this arrangement has a real physical significance, forces us to a conclusion which has already been reached on account of magnetic and chemical behavior, that when the electrons of the N levels are removed one or more of the extra electrons in the M levels moves out to the N levels more or less frequently. As we proceed toward heavier elements the likelihood of this happening seems clearly to decrease, as shown by the failing intensity of the doublets. Catalan[3] also found it necessary to assume some such transition to explain his multiplets.

There is very considerable doubt about the single

[1] Proc. Roy. Soc. of Can., Vol. XVIII, p. 103, 1924.
[2] *Astro. Phy. J.*, Vol. LXI, No. 1, Jan., 1925.
[3] Phil. Trans. A., Vol. 223, p. 166.

TABLE II

FIRST SINGLETS

Element	Wave length I. A. vac	I	Wave number
Ca I	4226.73	10 R	23652.4
Sc II	2273.8	5	43979
Ti III	1581.54	2	63229
V IV	1224.18	1	81687

line assigned to V IV. The accuracy of the irregular doublet law method is not great enough to distinguish among lines when several are present and the intensity is weak, for here the intensity falls regularly with increasing atomic number just as in the doublets.

Here again the intensity falls toward higher atomic numbers, as was clearly found for Sc and Ti, but the Ca group was not photographed in this work. The intensities are quoted from Russell and Saunders' paper.

TABLE III

SEXTETS

Element	Wave length I. A. vac	I	Wave number	Principal separation
	4318.65	45	23155	
	4307.74	45	23214	105
Ca I	4302.53	60	23242	
	4298.99	30	23261	52
	4289.38	40	23314	
	4283.01	30	23348	
	2563.30	2	39001	
	2560.35	3	39048	
Sc II	2555.90	2	39115	230
	2552.46	3	39168	
	2545.24	2	39279	113
	2540.94	1	39345	
	1802.97	1	55494	
	1797.10	0	55645	
Ti III	1792.58	1	55785	470
	1787.35	2	55949	
	1781.98	1	56117	158
	1777.63	1	56255	

It must be remembered that most of the tests for series relation are lacking in the extreme ultra-violet. The Zeeman effect and temperature classification of most of these lines is impossible to apply as yet. Even the outstanding intensity of these principal lines, which has been used as a guide in other elements, fails one. We are, therefore, left with little but the doublet laws, the accuracy in the application of which is not great.

My appreciation of the assistance of Dr. E. P. Clark in the preparation of the Sc is here gratefully acknowledged. These results will be discussed in greater detail eleswhere.

R. J. LANG

UNIVERSITY OF ALBERTA,
CANADA

STUDY ON SUGAR CANE MOSAIC[1]

DURING our investigations on the subject of susceptibility of different cane varieties to mosaic disease, a problem confronted us at the outset requiring immediate solution—that of a reliable method of inoculation. The desideratum was a method that would render the work as simple, rigid and as rapid as the work in animal pathology is rendered by the use of rats or guinea-pigs. A prerequisite of the method was, in addition, that each single individual cane should furnish material for duplicate inoculations and the relative uninoculated control. After trying many other methods with various degrees of satisfaction, some also involving the use of insect vectors, the procedure summarized below, which unites all the above-mentioned points of value, was adopted with satisfactory results.

The procedure adopted consists in obtaining, from the field, mature canes, the leaves and history of which indicate that the plant is free of disease. After having divided each cane into as many pieces as there are internodes with uninjured bud, two of the resulting seed pieces (one from the terminal and another from the basal portion of the cane) are separated and planted immediately to serve as controls. A hole is bored, in the remaining pieces diagonally into the node, immediately above the leaf scar and as close as possible to the bud, without thereby impairing this tissue. For this work a 3 mm sterile cork borer is used, the small core thus resulting being kept to seal the wound at the site of inoculation. In the hole thus prepared a small piece of fresh apical bud tissue, obtained from an infected cane, is introduced and crushed by means of a sterile glass rod. The hole is closed by means of the cork-borer core and the wound, finally, hermetically sealed with a small cotton plug soaked in melted paraffin. Planting is done soon after inoculation.

The infected tissue for inoculation should be removed from a freshly exposed apical bud only a few seconds before use, the cut being renewed for every prelevation of a new inoculum, in order to avoid undue aeration.

The results reported are hereby presented with no other intention than to show that the infective agent of cane mosaic, introduced in the tissue of the node (parenchyma and vascular bundles) is transmitted to the tissue of the apical bud and there maintained

[1] Contribution from the Chaparra Agricultural Experiment Station.

Variety of cane used	Number of experiment and of cane	Number of seed piece										
		Checks uninoculated		Inoculated								
		a	b	1	2	3	4	5	6	7	8	9	10	11
Foenix[2]	VI– 5	0	0	?	x	x	?	?	x	x				
Foenix	VI– 6	0	0	x	x	x	x	?	x	x	x			
Foenix	VI– 9	0	0	x	died	?	x	x	x	x	x	x		
Cavengerie	VIII–3	0	0	x	x	x	x	x	x	x	x	0	0	0

active for various days, even though this tissue is not, at the time, in a process of active growth.

In the accompanying table (where *0* corresponds to no infection, *x* to unquestionable and *?* to questionable infection) are reported some of the results secured in our work, the final readings being taken two months after inoculation in the case of the "Foenix" cane, and one month and ten days after inoculation in the case of the Cavengerie. The plants were grown, in this case, in an insect-proof cloth house with frequent preventive tobacco fumigations.

AUGUSTO BONAZZI

ORIENTE, CUBA

POST-LARVAL LOBSTERS

MUCH has been learned from time to time about the life habits of adult lobsters. This is also true of lobster eggs and of young fry. It is true, however, that very little has been known about young lobsters one, two and three years of age. These animals are very seldom seen. Many lobster fishermen, for example, have never seen a two-inch lobster.

During the two summers of 1919 and 1920 the writer undertook the work of capturing some of these very young lobsters. Accompanied by my son I began testing out all sorts of places in Richmond Bay, Prince Edward Island. This body of water was selected because the water is warm and shallow and the bay is well protected in every way.

Various methods for capturing lobsters were tried. First we tried the use of small traps. These were miniature models of the regular parlor traps used by fishermen, with the exception of a few, which consisted of only one compartment.

The traps were baited and set out in water varying in depth from two to ten feet at low tide. They were put in rocky, sandy, muddy and grassy places. Quite a number of lobsters under five inches were caught in this way, one of which measured two and one half inches in length.

We also worked with a beam trawl when the weather was favorable and obtained good results in places where the bottom was soft, and covered in spots with short eel grass. A good deal of time was spent walking along shore on fine days when the water was at low tide. One day, by great good fortune, we found a place where there were some holes in the soft bottom of the ocean. After investigating many of these openings we succeeded at last in locating several small lobsters hiding in these "burrows." It was also observed that some burrows had two openings, an entrance and an exit. In such cases the openings were from six to fifteen inches apart. The lobster was therefore prepared to use either opening when attacked by an enemy.

By using all the methods indicated above we captured 280 lobsters six inches and under, 154 lobsters five inches and under, fifty-four lobsters four inches and under and four lobsters three inches and under. The smallest measured two and one half inches in length.

All lobsters taken were examined, measured and recorded and afterwards liberated away from the places from which they were obtained.

The investigation proved two things: first, that there are certain natural breeding grounds for lobsters; and, secondly, that young lobsters hide in all sorts of places, under rocks, in grass and even in burrows.

So far as I know this is the first authentic record of lobsters actually found living in burrows.

The expense of this investigation was borne by the Biological Board of Canada, and the work was done under the supervision of the chairman, Dr. A. P. Knight.

D. A. MACKAY

COLLEGIATE INSTITUTE, OTTAWA

[2] Foenix is the provisional name given to a cane, received from the Foenix gardens in Habana, which closely resembles D 74.

THE NATIONAL ACADEMY OF SCIENCES

(*Continued from page 510*)

Observations on the nature of ossification: W. G. MACCALLUM.

Bone is formed in the cartilage along the line of ossification of the epiphysis, but not in that of the ears or

the rings of the trachea. Various explanations have been offered, such as differences in carbon dioxide tension, physical characters, etc., but none are satisfactory. There is iron in the cartilage at the line of ossification, as shown in 1902 by Gierke, but none in the non-ossifying cartilages. It seems possible that this determines the disposition of calcium phosphate in that line.

We have found that the presence of the iron is perhaps due to a special affinity of the matrix of the line of ossification for ferric salts, since it absorbs them from a solution, in sharp contrast with other cartilage. It has long been known that pathological calcification is usually, if not always preceded by a deposition of iron. Tissues artificially impregnated with iron and suspended in solutions of calcium and phosphates become loaded with calcium phosphate more readily than those which contain no iron.

If a series of test tubes be set up, with constant quantities of calcium and increasing concentrations of phosphates, or vice versa, and kept at constant reaction, precipitation will occur after 12–24 hours at that point at which the concentration is sufficient. If these solutions are left standing long enough, precipitation gradually appears at less and less concentration, and would probably appear in the course of years in the most dilute.

If a trace of iron salt be added to each of a similar series of tubes, precipitation occurs far more rapidly, so that in a given time it appears in mixtures of far less concentration than those in which it takes place spontaneously. The iron seems to affect the velocity of the reaction rather than the mass action.

Epidemic encephalitis and simple herpes: SIMON FLEXNER.

The death rate from diphtheria in Massachusetts for 51 years, 1875–1925: CARL R. DOERING. (Communicated by Edwin B. Wilson.)

Thyroid and parathyroid in the chemical differentiation of bone: FREDERICK S. HAMMETT (introduced by Henry H. Donaldson).

Bones grow by increments of water, ash and organic matter. The percentage of water decreases, while that of organic matter and ash increase with the progress of growth. The decrease in ash percentage is largely due to ash deposition. In conditions of thyroid and parathyroid deficiency, bones grow less rapidly than normal. This reduction is not a simple proportionate affair in which the three constituents studied participate in equal degree, but is disproportionate. This indicates a distortion of the normal relations. The bones of the thyroidless rats show a definite tendency towards a lesser percentage of water, and a higher percentage of ash and organic matter than is to be expected for the bone weight. In this sense ossification is apparently not abnormally retarded in conditions of thyroid deficiency. The normal reciprocal relation between water and ash is, however, disturbed. In the bones of the parathyroidless rats a different situation is found. The normal reciprocal relation between water and ash is maintained. In the bones of the female there is a very evident tendency towards a lower percentage of ash and a higher percentage of water than that to be expected on the basis of actual bone weight. This indicates a retardation of ossification. In the male this trend is neither marked nor consistent. The greater sensitivity of the female is likewise exhibited in the thyroidless rats. In both sexes parathyroid deficiency produces no significant distortion of organic matter percentage. It is clear that the two types of glandular deficiency produce two distinct types of distortion in the chemical differentiation of bone during growth. It is probable that the chief factor in the production of the observed end results in the thyroidless groups is the disturbance of the water exchange of the organism, a phenomenon which has been observed in the blood and central nervous system of these same animals. In the parathyroidless groups it is probable that the disturbance of the calcium metabolism is the initiating factor in the distortion. In this study the humerus and femur of 135 rats thyro-parathyroidectomized at 23, 30, 50, 65, 75, and 100 days of age and allowed to grow until 150 days old, and their litter controls were analyzed, and those of 161 rats parathyroidectomized at like ages and kept under like conditions of diet and environment with their litter mate controls. All the rats were healthy and free from vermin. They had a common inheritance, being the descendants of two pair.

The permeability of mammalian erythrocytes and certain other cells to ammonium salts: M. H. JACOBS (introduced by C. E. McClung).

The recent studies of Michaelis on the properties of artificial membranes permeable to ions of one sign of charge and not to those of the opposite sign might be applied to the mammalian erythrocyte except for the fact that these bodies are generally believed to be permeable not only to anions but also to the two cations, H and NH_4. It has been pointed out by others that apparent permeability to H ions might equally well be explained as due to permeability to OH′ ions. The case of the NH_4 ion which therefore presents the most serious remaining difficulty is that here considered.

Evidence is given that an ammonium salt such as NH_4Cl gains access to the erythrocyte by the penetration of undissociated ammonia followed by an exchange of OH′ and Cl′ ions. The ammonium as such does not appear to enter. In cells where an exchange of anions can not occur the peculiar penetrating power of ammonium salts largely disappears. The egg of Arbacia has been used for purposes of comparison with the mammalian erythrocyte. Finally, studies on the nucleated erythrocytes of a fish show that they resemble in this regard other nucleated cells rather than mammalian erythrocytes.

Quantitative potentiometric measurements on intra-cellular pH values of single fundulus egg cells: J. H. BODINE (introduced by C. E. McClung).

Studies on internal reactions of cells as well as permeability of cells to acid and chemicals have usually been concerned with changes in the color of intra-vital indicators introduced or taken up by the cell as well as changes in naturally occurring cellular pigments. Mortality and other functional changes have also been used as criteria of penetration of chemicals into cells. In all of these methods no accurate quantitative measurements of intracellular changes are obtained due to the inherent errors and limitations in such procedures. Data obtained by these methods, however, show intra-cellular reactions to be normally of an acid nature.

By means of an especially devised micro-hydrogen electrode and vessels, requiring extremely small quantities of fluid (0.01 cc.), it has been found possible to satisfactorily measure in an accurate quantitative way the intracellular reactions (pH) of single egg cells of the marine fish, *Fundulus heteroclitus*. Three separate determinations can be made on a single egg cell. Both fertilized and unfertilized egg cells were used.

The internal reactions (pH) of unfertilized egg cells, as determined when cells are taken directly from the female, are acid; an average pH of 6.39. Upon standing in sea water for periods of 72 hours or longer the unfertilized eggs become more acid in reaction. Variations in the internal pH values of unfertilized eggs have been found to be due to differences in the age of the eggs as taken from the female. Fertilized eggs also show an internal acid reaction, an average pH of 6.39, as well as a much less greater degree of variation than shown by unfertilized eggs of different ages. No marked changes in internal reactions of the eggs were detected during the course of development of the embryo.

It is of some interest to note that *Fundulus* eggs, normally living in sea water and exposed to fairly high alkaline reactions (pH 8.2), show a marked intra-cellular acidity (pH 6.39).

Rates of penetration of acid (HCL) into the eggs of *Fundulus* were also studied by means of this method. The extremely high resistance of the egg to acid is strikingly shown by the fact that considerably long exposures to acid (HCL-pH 4.3) are necessary before any appreciable change in internal pH takes place. It has also been found that cessation of heart beat and other functional changes in the embryo are not necessarily correlated with changes in the internal pH of the egg cell.

Suggestions regarding protoplasmic surfaces: W. J. V. OSTERHOUT.

By employing large multinucleate cells (one to six inches in length) certain experiments can be performed which are impossible with cells of ordinary size. Use has been made of this in the study of protoplasmic surfaces. In the case of *Valonia macrophysa* it is found that few salts penetrate and these with great slowness. This could be accounted for by supposing that the outer surface of the protoplasm permits little or no penetration of ions but allows certain undissociated molecules to pass. This agrees with experiments on electrical conductivity (made with direct current) and with measurements of the potential differences across the protoplasmic layer. It is not certain that no ions enter the protoplasm as such, but if ions enter it must be to a very slight extent or else their relative mobilities must be greatly reduced.

It seems probable that selective permeability may be exercised with respect to undissociated molecules rather than with respect to single ions (its seat may be at the external surface or deeper in the protoplasm). If selective permeability were exercised with respect to single ions we should expect salts which penetrate to give a different P. D. from those which do not. This is in general not the case in *Valonia*, at least not to any marked extent.

In the case of *Valonia* contact may be made with the interior of the cell by means of a glass capillary (filled with sap) which is inserted through the protoplasm into the vacuole. This apparently permits us to approximate the absolute values of the P. D. across the protoplasm at any point where an external contact is made. In the case of Nitella such absolute values may be approximated by other methods.

It may also be possible to obtain approximate values for the absolute P. D.'s of the inner, and likewise of the outer, protoplasmic surface under certain conditions.

The physical properties of erythrocytes: WILLIAM SEIFRIZ (introduced by Henry H. Donaldson).

The red corpuscle of amphibians is a disk-shaped cell containing a huge nucleus, and a thin layer of cytoplasm (haemoglobin) enclosed by a resistant pellicle. The cell as a whole is quite elastic. It can, with the aid of micro-needles, be stretched to four times its length. The pellicle may exhibit highly elastic qualities or at other times be more plastic. It, like all cell membranes, is but a more concentrated layer of the protoplasm, capable of undergoing the same changes in physical properties that any protoplasmic mass undergoes. The cytoplasmic content of the corpuscle is a more fluid substance. The nucleus is of high viscosity and extraordinarily elastic. A liberated nucleus 14 μ in diameter may be stretched to a fine thread 350 μ long, and on release of the micro-needles the nuclear material returns to nearly its original size. The human erythrocyte exhibits physical properties similar to those of amphibians in regard to the cell membrane and the haemoglobin-containing contents. The 8 by 9 μ human corpuscle is a biconcave disk which may assume the form of an invaginated sphere or a cup. The cell as a whole is usually plastic, but may exhibit marked elastic qualities. The high elasticity of protoplasm points conclusively to a fibrous and possibly crystalline structure, that structure which is characteristic of all proteins.

If we are justified in assuming the presence of an ultimate living substance in cells that substance is certainly protein in nature.